Naval Oceanographic and
Atmospheric Research Laboratory

Technical Note 112
June 1991

SEVERE WEATHER GUIDE MEDITERRANEAN PORTS

36. LIMASSOL

ABSTRACT

This handbook for the port of Limassol, one in a series of severe weather guides for Mediterranean ports, provides decision-making guidance for ship captains whose vessels are threatened by actual or forecast strong winds, high seas, restricted visibility or thunderstorms in the port vicinity. Causes and effects of such hazardous conditions are discussed. Precautionary or evasive actions are suggested for various vessel situations. The handbook is organized in four sections for ready reference: general guidance on handbook content and use; a quick-look captain's summary; a more detailed review of general information on environmental conditions; and an appendix that provides oceanographic information.

ACKNOWLEDGMENTS

The support of the sponsors - Naval Oceanography Command, Stennis Space Center, MS: and Fleet Numerical Oceanography Center, Monterey, CA (Program Element O&M,N) - is gratefully acknowledged.

CONTENTS

FOREWORD

This handbook on Mediterranean Ports was developed as part of an ongoing effort at the Atmospheric Directorate, Naval Oceanographic and Atmospheric Laboratory (NOARL), Monterey, to create products for direct application to Fleet Operations. The research was conducted in response to Commander Naval Oceanography Command (COMNAVOCEANCOM) requirements validated by the Chief of Naval Operations (OP-096).

As mentioned in the preface, the Mediterranean region is unique in that several areas exist where local winds can cause dangerous operating conditions. This handbook will provide the ship's captain with assistance in making decisions regarding the disposition of his ship when heavy winds and seas are encountered or forecast at various port locations.

Readers are urged to submit comments, suggestions for changes, deletions and/or additions to Naval Oceanography Command Center (NAVOCEANCOMCEN), Rota with a copy to the oceanographer, COMSIXTHFLT. They will then be passed on to NOARL, Monterey for review and incorporation as appropriate. This document will be a dynamic one, changing and improving as more and better information is obtained.

PORT INDEX

The following is a tentative prioritized list of Mediterranean Ports to be evaluated during the five-year period 1988-92, with ports grouped by expected year of the port study's publication. This list is subject to change as dictated by circumstances and periodic review. Computerized versions of these port guides are available for those ports with an asterisk (*). Contact the Atmospheric Directorate, NOARL, Monterey or NOCC Rota for IBM compatable floppy disk copies.

NO.	PORT
*1	GAETA, ITALY
*2	NAPLES, ITALY
*3	CATANIA, ITALY
*4	AUGUSTA BAY, ITALY
*5	CAGLIARI, ITALY
*6	LA MADDALENA, ITALY
7	MARSEILLE, FRANCE
8	TOULON, FRANCE
9	VILLEFRANCHE, FRANCE
10	MALAGA, SPAIN
11	NICE, FRANCE
12	CANNES, FRANCE
13	MONACO
14	ASHDOD, ISRAEL
15	HAIFA, ISRAEL
16	BARCELONA, SPAIN
17	PALMA, SPAIN
18	IBIZA, SPAIN
19	POLLENSA BAY, SPAIN
20	LIVORNO, ITALY
21	LA SPEZIA, ITALY
22	VENICE, ITALY
23	TRIESTE, ITALY
*24	CARTAGENA, SPAIN
*25	VALENCIA, SPAIN
*26	SAN REMO, ITALY
*27	GENOA, ITALY
*28	PORTO TORRES, ITALY
*29	PALERMO, ITALY
*30	MESSINA, ITALY
*31	TAORMINA, ITALY

1991	PORT
*32	TARANTO, ITALY
*33	TANGIER, MOROCCO
*34	BENIDORM, SPAIN
*35	ROTA, SPAIN
*36	LIMASSOL, CYPRUS
*37	LARNACA, CYPRUS
*38	ALEXANDRIA, EGYPT
*39	PORT SAID, EGYPT
40	BIZERTE, TUNISIA
41	TUNIS, TUNISIA
42	SOUSSE, TUNISIA
43	SFAX, TUNISIA
44	SOUDA BAY, CRETE
	VALETTA, MALTA
	PIRAEUS, GREECE

1992	PORT
	KALAMATA, GREECE
	CORFU, GREECE
	KITHIRA, GREECE
	THESSALONIKI, GREECE
	DELAYED INDEFINITELY
	ALGIERS, ALGERIA
	ISKENDERUN, TURKEY
	IZMIR, TURKEY
	ISTANBUL, TURKEY
	ANTALYA, TURKEY
	GOLCUK, TURKEY

PREFACE

Environmental phenomena such as strong winds, high waves, restrictions to visibility and thunderstorms can be hazardous to critical Fleet operations. The cause and effect of several of these phenomena are unique to the Mediterranean region and some prior knowledge of their characteristics would be helpful to ship's captains. The intent of this publication is to provide guidance to the captains for assistance in decision making.

The Mediterranean Sea region is an area where complicated topographical features influence weather patterns. Katabatic winds will flow through restricted mountain gaps or valleys and, as a result of the venturi effect, strengthen to storm intensity in a short period of time. As these winds exit and flow over port regions and coastal areas, anchored ships with large 'sail areas' may be blown aground. Also, hazardous sea state conditions are created, posing a danger for small boats ferrying personnel to and from port. At the same time, adjacent areas may be relatively calm. A glance at current weather charts may not always reveal the causes for these local effects which vary drastically from point to point.

Because of the irregular coast line and numerous islands in the Mediterranean, swell can be refracted around such barriers and come from directions which vary greatly with the wind. Anchored ships may experience winds and seas from one direction and swell from a different direction. These conditions can be extremely hazardous for tendered vessels. Moderate to heavy swell may also propagate outward in advance of a storm resulting in uncomfortable and sometimes dangerous conditions, especially during tending, refueling and boating operations.

This handbook addresses the various weather conditions, their local cause and effect and suggests some evasive action to be taken if necessary. Most of the major ports in the Mediterranean will be covered in the handbook. A priority list, established by the Sixth Fleet, exists for the port studies conducted and this list will be followed as closely as possible in terms of scheduling publications.

RECORD OF CHANGES

CHANGE NUMBER	DATE OF CHANGE	DATE ENTERED	PAGE NUMBER	ENTERED BY

1. GENERAL GUIDANCE

1.1 DESIGN

This handbook is designed to provide ship captains with a ready reference on hazardous weather and wave conditions in selected Mediterranean harbors. Section 2, the captain's summary, is an abbreviated version of section 3, the general information section intended for staff planners and meteorologists. Once section 3 has been read, it is not necessary to read section 2.

1.1.1 Objectives

The basic objective is to provide ship captains with a concise reference of hazards to ship activities that are caused by environmental conditions in various Mediterranean harbors, and to offer suggestions for precautionary and/or evasive actions. A secondary objective is to provide adequate background information on such hazards so that operational forecasters, or other interested parties, can quickly gain the local knowledge that is necessary to ensure high quality forecasts.

1.1.2 Approach

Information on harbor conditions and hazards was accumulated in the following manner:

A. A literature search for reference material was performed.
B. Cruise reports were reviewed.
C. Navy personnel with current or previous area experience were interviewed.
D. A preliminary report was developed which included questions on various local conditions in specific harbors.
E. Port/harbor visits were made by NOARLW personnel; considerable information was obtained through interviews with local pilots, tug masters, etc; and local reference material was obtained.
F. The cumulative information was reviewed, combined, and condensed for harbor studies.

1.1.3 Organization

The Handbook contains two sections for each harbor. The first section summarizes harbor conditions and is intended for use as a quick reference by ship captains, navigators, inport/at sea OOD's, and other interested personnel. This section contains:

A. a brief narrative summary of environmental hazards,
B. a table display of vessel location/situation, potential environmental hazard, effect-precautionary/evasion actions, and advance indicators of potential environmental hazards,
C. local wind wave conditions, and
D. tables depicting the wave conditions resulting from propagation of deep water swell into the harbor.

The swell propagation information includes percent occurrence, average duration, and the period of maximum wave energy within height ranges of greater than 3.3 feet and greater than 6.6 feet. The details on the generation of sea and swell information are provided in Appendix A.

The second section contains additional details and background information on seasonal hazardous conditions. This section is directed to personnel who have a need for additional insights on environmental hazards and related weather events.

1.2 CONTENTS OF SPECIFIC HARBOR STUDIES

This handbook specifically addresses potential wind and wave related hazards to ships operating in various Mediterranean ports utilized by the U.S. Navy. It does not contain general purpose climatology and/or comprehensive forecast rules for weather conditions of a more benign nature.

The contents are intended for use in both previsit planning and in situ problem solving by either mariners or environmentalists. Potential hazards related to both weather and waves are addressed. The

oceanographic information includes some rather unique information relating to deep water swell propagating into harbor shallow water areas.

Emphasis is placed on the hazards related to wind, wind waves, and the propagation of deep water swell into the harbor areas. Various vessel locations/situations are considered, including moored, nesting, anchored, arriving/departing, and small boat operations. The potential problems and suggested precautionary/evasive actions for various combinations of environmental threats and vessel location/situation are provided. Local indicators of environmental hazards and possible evasion techniques are summarized for various scenarios.

CAUTIONARY NOTE: In September 1985 Hurricane Gloria raked the Norfolk, VA area while several US Navy ships were anchored on the muddy bottom of Chesapeake Bay. One important fact was revealed during this incident: Most all ships frigate size and larger dragged anchor, some more than others, in winds of over 50 knots. As winds and waves increased, ships 'fell into' the wave troughs, BROADSIDE TO THE WIND and become difficult or impossible to control.

This was a rare instance in which several ships of recent design were exposed to the same storm and much effort was put into the documentation of lessons learned. Chief among these was the suggestion to evade at sea rather than remain anchored at port whenever winds of such intensity were forecast.

2. CAPTAIN'S SUMMARY

The Port of Limassol is located on the south coast of the island of Cyprus at approximately 34°40'N 33°02'E (Figure 2-1).

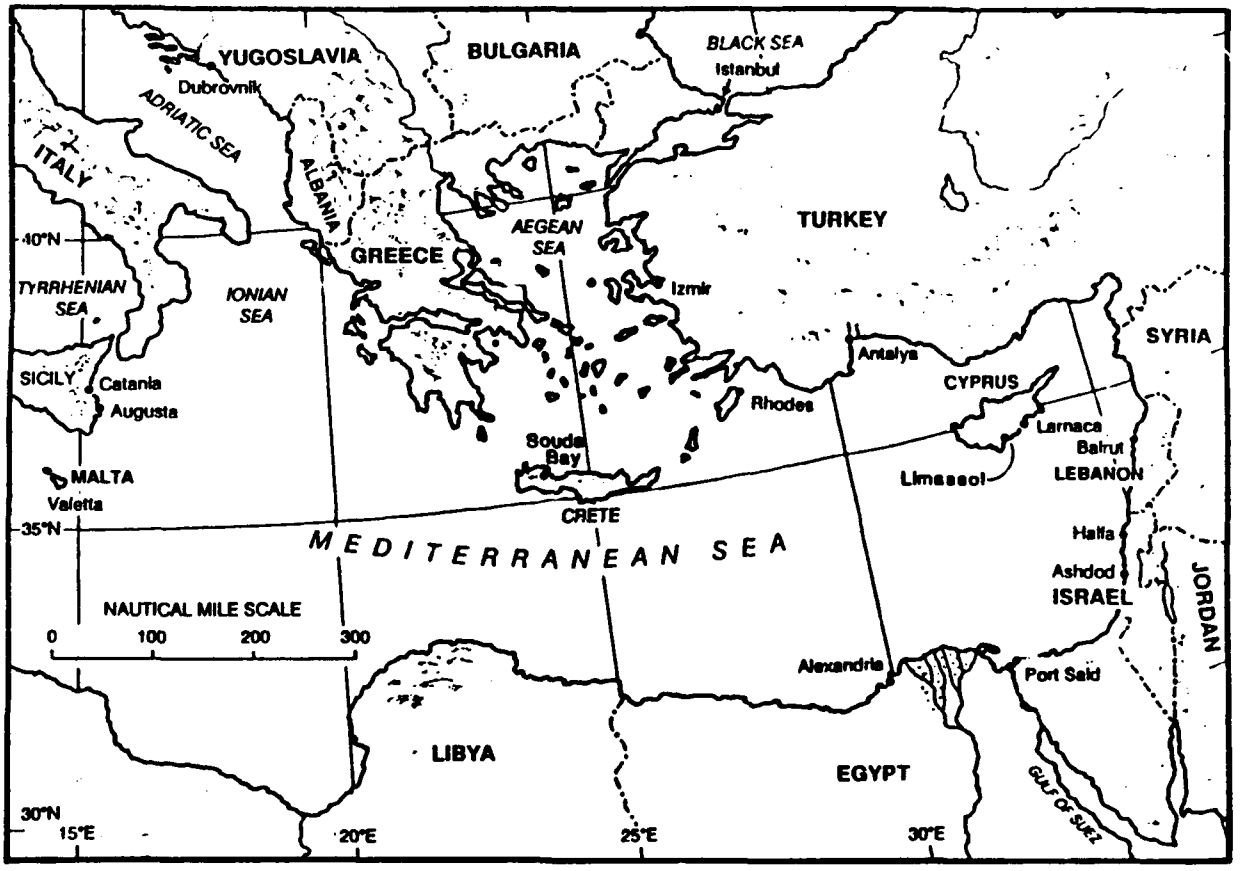

Figure 2-1. Eastern Mediterranean Sea.

The port is situated on the east side of the Akrotiri Peninsula, about 5 n mi north of Cape Gata, the southernmost point on Cyprus (Figure 2-2). The terrain immediately adjacent to Limassol is mostly low-lying, but the Troodos Mountains, with elevations exceeding 5,000 ft (1,524 m), are located north of the port. Elevations over 1,640 ft (500 m) are within 9 n mi of the port. Large salt pans lie southwest of the port on the Akrotiri Peninsula. (Figure 2-2)

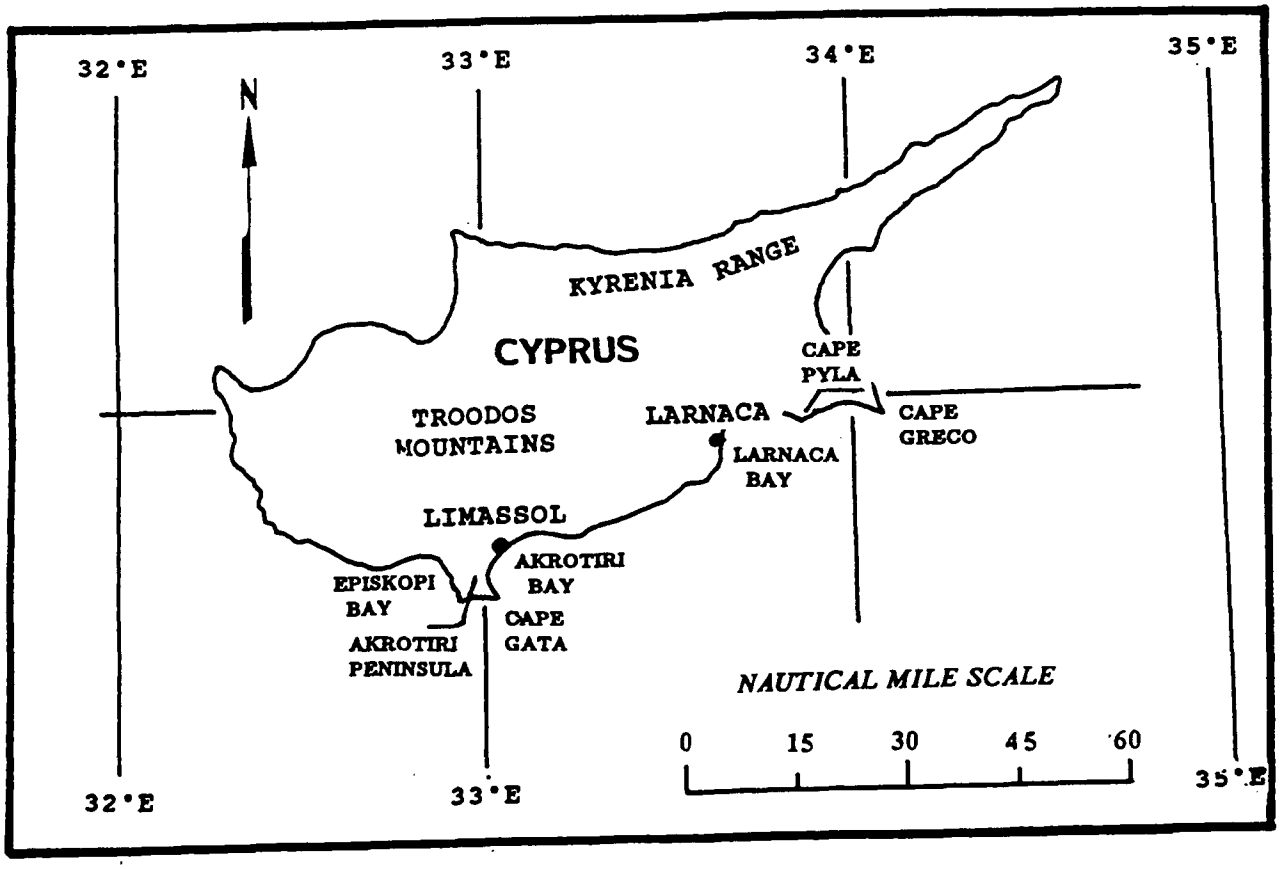

Figure 2-2. Cyprus.

The Port of Limassol is located on the northwest coast of Akrotiri Bay (Figure 2-3). The port is comprised of two harbors and two anchorages. The commercial harbor is the largest, and is capable of handling vessels up to frigate size for berthing in 36 ft (11 m) of water. Berthing is unrestricted, but the harbor is very busy and berthing space may not be available. It is entered through an approach channel which is 39 ft (12 m) deep and 492 ft (150 m) wide between the ends of two breakwaters. A fleet landing is established on the north end of the inner harbor at pier #1. (Figure 2-3)

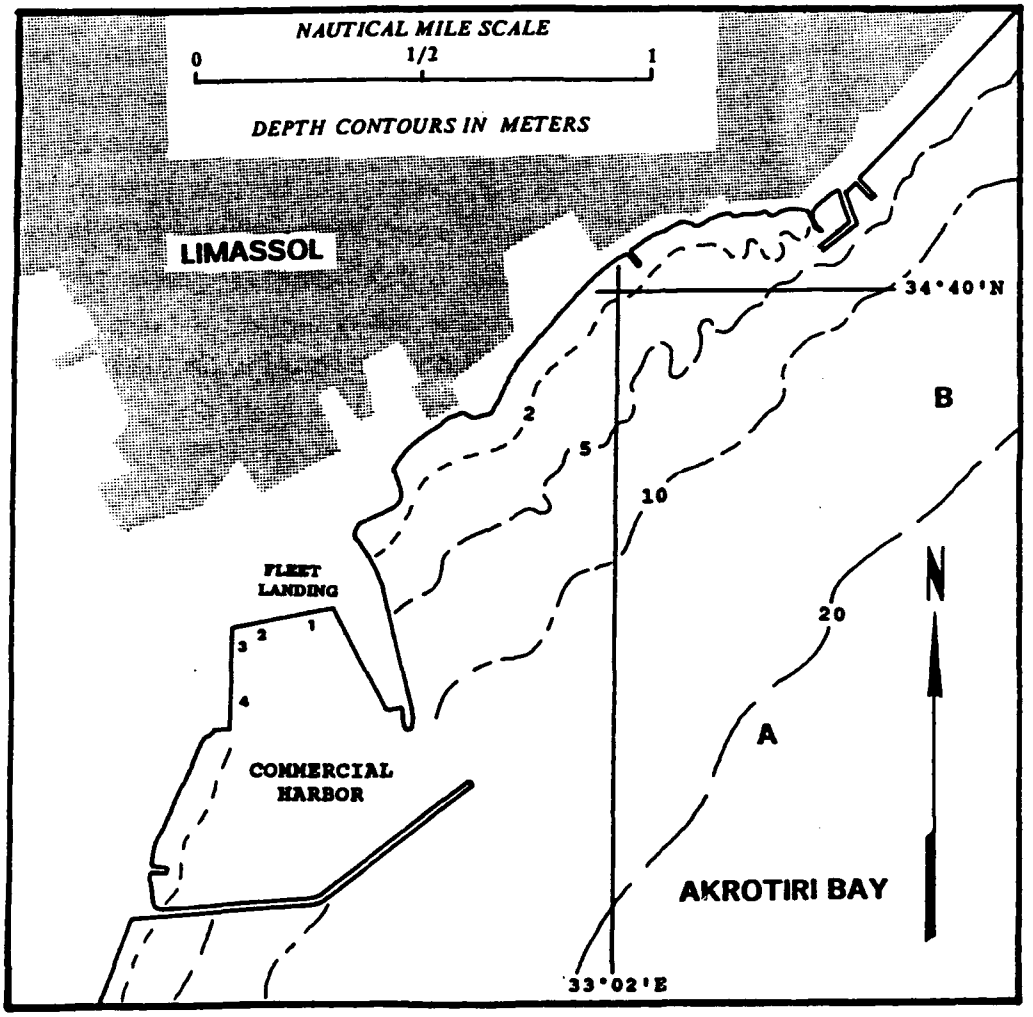

Figure 2-3. Port of Limassol, Cyprus.

Because of the orientation of the entrance, the commercial harbor offers good protection from waves from most directions. However, steady winds with a strong easterly component can bring waves to 13 ft (4 m) into the harbor. At times, swell will amplify at the harbor entrance. Easterly swell is partially absorbed by a rocky beach, but some reflection occurs in the northeast corner of the harbor.

A smaller, older harbor is located about 1 1/3 n mi northeast of the commercial harbor. It is used by Navy ships primarily as a fleet landing for small boats from ships utilizing a small-ship anchorage near the harbor. The size of the harbor and shallow depths do not allow larger vessels to enter. The harbor is well protected from waves, but small boats may have problems entering during strong easterly winds. During such situations small boats should still be able to enter the commercial harbor.

Large vessels, such as aircraft carriers, anchor in an anchorage located a little less than 1 n mi east of the commercial harbor entrance (indicated by the letter "A" in Figure 2-3). Smaller vessels can use the small-ship anchorage located about 1/2 n mi southeast of the smaller harbor (indicated by the letter "B" in Figure 2-3). The small-ship anchorage is very congested, however. Holding in the anchorages is good on a bottom of mud and sand. No anchor dragging has been reported in 17 years for vessels with good ground tackle, even in winds of gale force. Both anchorages are exposed to winds and waves from the southeast semicircle. Persistent (2-3 days) easterly winds may generate 13 ft (4 m) waves which last up to 20 hours after the wind ceases. If conditions in the anchorages are severe, Episcopi Bay on the west side of the Akrotiri Peninsula (Fig. 22) provides good shelter from easterly wind and swell.

Tides are negligible at Limassol, and currents are wind driven.

Specific hazardous conditions, vessel situations, and suggested precautionary/evasive actions scenarios are summarized in Table 2-1.

Table 2-1. Summary of hazardous environmental

HAZARDOUS CONDITION	INDICATORS OF POTENTIAL HAZARDS	VESSEL SITUATIC
1. E'ly winds/waves - locally called levante. * Creates worst conditions for the port. * Typical storm brings 35-40 kt wind, max 50 kt. * 13 ft (4 m) swell reaches port. * Swell sometimes enters inner harbor. * Swell may be amplified at harbor entrance.	Advance warning. * Existing or building high pressure over Turkey and coincident low pressure to the S near Egypt. * A lowering of the water level in the harbor by 8 to 12 inches (20-30 cm). Duration. * A persistent (2-3 days) wind can raise a swell which will last up to 20 hours after wind abates.	(1) Moor cial harl (2) Ancl (3) Arr dep (4) Smal

ry of hazardous environmental conditions for the Port of Limassol, Cyprus.

RS OF AZARDS	VESSEL LOCATION/ SITUATION AFFECTED	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS
uilding high Turkey and w pressure to ypt. the water harbor by 8 to -30 cm).	(1) Moored - commercial harbor.	(a) Creates the worst weather conditions in the harbor. * Although seemingly protected, E'ly swell to 13 ft (4 m) has entered the harbor, causing damage to moored vessels. * Moored vessels should monitor weather forecasts and watch water level to see if strong winds are expected, and double/add mooring lines as required. * At times, swell is amplified at harbor entrance.
(2-3 days) wind well which will hours after	(2) Anchored.	(a) Creates the worst weather conditions at the anchorages. * Holding is good on a mud and sand bottom, and anchor dragging is not a problem for ships with good ground tackle, even with winds of gale force. * If conditions are severe, Episkopi Bay W of Akrotiri Peninsula provides good shelter from E wind and swell.
	(3) Arriving/ departing	(a) Creates the worst weather conditions in the harbor and at the anchorages. * Although seemingly well protected from E'ly swell, under certain conditions swell to 13 ft (4 m) has entered the harbor, causing damage to moored vessels. * Arriving vessels should monitor weather forecasts to see if strong winds are expected, and double/add mooring lines as required upon mooring. * At times, swell is amplified at harbor entrance. * Holding is good on a mud and sand bottom, and anchor dragging is not a problem for ships with good ground tackle, even with winds of gale force. * If conditions are severe in the anchorage, Episkopi Bay W of Akrotiri Peninsula provides good shelter from E wind and swell.
	(4) Small boats.	(a) Small boats may have problems entering the old harbor during strong E winds, but should still be able to enter the commercial harbor.

Table 2-1. (continued)

HAZARDOUS CONDITION	INDICATORS OF POTENTIAL HAZARDS	VES SITU
2. Bora winds - W to NW winds which may spread SE from the Aegean Sea to the Cyprus area. * Strongest in winter and early spring, uncommon in summer and early autumn. * Direction is W near Cyprus. * Little effect on ships in port, but may affect arriving/departing vessels.	Advance warning. * Cold air invasion of Aegean Sea which exceeds 5,000 ft in depth. If the depth is less than 5,000 ft, Bora winds will not reach the E Mediterranean area.	(1) cial (2) (3) (4)
3. Scirocco event - Warm SE to SW wind which reaches the Cyprus area from N Africa. * Strongest in winter and early spring, uncommon in summer and early autumn. * Associated swell may reach anchorage. * Associated weather may include low stratus, fog and drizzle with reduced visibility. * Heavy rain is likely near frontal boundaries and topographical barriers such as the mountains of Cyprus.	Advance warning. * Usually found E of cyclones that develop either over the S Aegean Sea/Sea of Crete or near Cyprus. * Strong S'ly winds at stations along the NE coast of Libya may indicate Scirocco onset.	(1) cial (2) (3) (4)

Table 2-1. (continued)

TORS OF HAZARDS	VESSEL LOCATION/ SITUATION AFFECTED	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS
vasion of Aegean xceeds 5,000 ft f the depth is ,000 ft, Bora not reach the E an area.	(1) Moored - commercial harbor.	(a) Minimal impact.
	(2) Anchored.	(a) Minimal impact.
	(3) Arriving/ departing.	(a) Minimal impact on the port. * Outgoing vessels would be exposed to winds/waves once clear of the protection of the Akrotiri Peninsula, and should expect heavier weather.
	(4) Small boats.	(a) Minimal impact.
nd E of cyclones either over the /Sea of Crete or winds at sta- the NE coast of ndicate Scirocco	(1) Moored - commercial harbor.	(a) Minimal impact. * The inner harbor is well protected from wind and waves with S'ly component. * Vessels should monitor weather broadcasts to see if strong winds are expected and double/add mooring lines as necessary. * Extremely anomalous radar and radio propagation may be experienced due to a strong low level inversion.
	(2) Anchored.	(a) Minimal impact. * A steady wind of 20 kt could raise waves to 8 ft in the anchorages. * Extremely anomalous radar and radio propagation may be experienced due to a strong low level inversion.
	(3) Arriving/ departing.	(a) Minimal impact. * Incoming vessels should monitor weather broadcasts to see if strong winds are expected and double/add mooring lines as required when mooring. * Incoming vessels should be aware that a steady wind of 20 kt could raise 8 ft waves in the anchorages, but should pose no problem for anchored vessels. * Extremely anomalous radar and radio propagation may be experienced due to a strong low level inversion.
	(4) Small boats.	(a) Little significant effect. * Waves in the anchorages may make boat work uncomfortable.

Table 2-1. (continue

HAZARDOUS CONDITION	INDICATORS OF POTENTIAL HAZARDS	VE SITU
4. Cyprus depression - Most intense during November-April period. * Associated weather includes strong-to-gale force, squally winds with heavy showers.	Advance warning. * Decreasing atmospheric pressure over the area between the Gulf of Antalya and Cyprus. * Cyclones also form over the S Aegean Sea and Sea of Crete. If one forms along the leading edge of a significant surge of cold air, it may move to the Cyprus area.	(1) cia (2) (3) (4)
5. Etesian winds - Direction near Cyprus may be from W to N, but will be W near Limassol. * Primarily a summer event. * Wind is enhanced as it crosses Akrotiri Peninsula, often reaching gale force in afternoons. * Increased winds and seas may be encountered S of Cape Gata by arriving/departing units.	Advance warning. * If strong N to NW'ly flow occurs over the Aegean Sea, Etesian winds may reach the Cyprus area.	(1) cia (2) (3) (4)

Table 2-1. (continued)

TORS OF L HAZARDS	VESSEL LOCATION/ SITUATION AFFECTED	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS
. atmospheric pres- the area between f Antalya and lso form over the ea and Sea of one forms along g edge of a sig- urge of cold air, e to the Cyprus	(1) Moored - commercial harbor.	(a) Little significant effect. * The potential for strong, gusty winds and heavy showers exists.
	(2) Anchored.	(a) Little significant effect. * The potential for strong, gusty winds and heavy showers exists.
	(3) Arriving/ departing.	(a) Little significant effect. * The potential for strong, gusty winds and heavy showers exists.
	(4) Small boats.	(a) Little significant effect. * The potential for strong, gusty winds and heavy showers exists.
. N to NW'ly flow r the Aegean Sea, nds may reach the a.	(1) Moored - commercial harbor.	(a) Moored vessels should be prepared for W'ly afternoon winds of 30+ kt. * Double/add mooring lines as required.
	(2) Anchored.	(a) Afternoon winds of 30+ kt may affect the small-ship anchorage. * It is advisable for smaller vessels to anchor farther S than the normal small-ship anchorage.
	(3) Arriving/ departing.	(a) Localized effects in the port area may not be obvious to ships approaching the port from S. * Afternoon winds of 30+ kt may affect the small-ship anchorage, making it advisable for smaller vessels to anchor farther S than the normal small-ship anchorage. * Arriving ships may need to double/add mooring lines as required when mooring to mitigate effects of increased afternoon winds of 30+ kt. * Departing vessels should expect heavier weather when clear of the protection of Akrotiri Peninsula.
	(4) Small boats.	(a) Strong afternoon winds may make boat work uncomfortable.

Table 2-1. (continued

HAZARDOUS CONDITION	INDICATORS OF POTENTIAL HAZARDS	VESS SITUA
6. N African cyclones - Develop over N Africa, causing warm S'ly winds over E Mediterranean Sea. * Most common in spring. May occur in winter and autumn but is uncommon in summer. * Biggest problems for the port are the Scirocco conditions (see section 3. above) which may develop ahead of the low pressure system.	Advance warning. * Difficult to ascertain due to scarcity of timely surface weather reports over N Africa.	(1) M cial (2) A (3) A d (4) S

Table 2-1. (continued)

ORS OF HAZARDS	VESSEL LOCATION/ SITUATION AFFECTED	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS
o ascertain due of timely sur- r reports over N	(1) Moored - commercial harbor.	(a) Minimal impact. * The inner harbor is well protected from wind and waves with S'ly component. * Vessels should monitor weather broadcasts to see if strong winds are expected and double/add mooring lines as necessary. * Extremely anomalous radar and radio propagation may be experienced due to a strong low level inversion.
	(2) Anchored.	(a) Minimal impact. * A steady wind of 20 kt could raise waves to 8 ft in the anchorages. * Extremely anomalous radar and radio propagation may be experienced due to a strong low level inversion.
	(3) Arriving/ departing.	(a) Minimal impact. * Incoming vessels should monitor weather broadcasts to see if strong winds are expected and double/add mooring lines as required when mooring. * Incoming vessels should be aware that a steady wind of 20 kt could raise 8 ft waves in the anchorages, but should pose no problem for anchored vessels. * Extremely anomalous radar and radio propagation may be experienced due to a strong low level inversion.
	(4) Small boats.	(a) Little significant effect. * Waves in the anchorages may make boat work uncomfortable.

SEASONAL SUMMARY OF HAZARDOUS WEATHER CONDITIONS

WINTER (November through February)

* Easterly winds (called levante) bring the worst weather to the port. Expect 23 stormy days per average winter. Typical storm is 35-40 kt with 50 kt maximum. Can bring 13 ft (4 m) waves to anchorage. Waves have entered commercial harbor, causing damage. Waves sometimes amplify at the harbor entrance. Swell generated by persistent (2-3 day duration) easterly winds may last up to 20 hours after wind ceases.
* West-southwest winds predominate, but harbor is protected.
* Bora. A Bora is a cold wind originating in the Aegean Sea which may reach the eastern Mediterranean Sea. Direction is west-northwesterly in the eastern Mediterranean and westerly just south of Limassol. Convective clouds and shower activity normally accompany Bora conditions.
* Scirocco. Southeast to southwesterly winds. Warm in winter. May be accompanied by dust, low stratus, fog, and drizzle with low visibility. Anomalous radar and radio propagation are likely. Heavy rain is possible.
* Cyprus depressions. Usually develop between Cyprus and Turkey. May be accompanied by strong-to-gale force, squally winds with heavy showers. Scirocco conditions may occur ahead of the developing low.

SPRING (March through May)

* Early spring is similar to winter, with Bora, Scirocco, and Cyprus depressions possible. Late spring is similar to summer conditions.
* North African cyclones are common during spring. Associated weather on Cyprus would be similar to Scirocco conditions.

* Fog may reduce early morning visibility to near zero, clearing by 0830L.

SUMMER (June through September)

* Westerly winds (Etesian) prevail over eastern Mediterranean Sea.
* A local westerly wind (called the Provences) is amplified as it crosses the Akrotiri Peninsula, sometimes reaching gale force.
* Settled weather prevails. Precipitation is uncommon.

AUTUMN (October)

* Short transition season with winter-like weather returning by month's end.

The following is a copy of a "Phoenician Wind Prediction Calendar" that was obtained during a visit to the Port of Limassol. It should be applicable to all of Cyprus, and may be of use in anticipating wind events at both Limassol and Larnaca. The calendar is reported to be 90% successful. According to local authorities, if wind does not occur, it is late, not absent.

PHOENICIAN WIND PREDICTION CALENDAR

APPROX. DATE	LOCAL NAME	TRANSLATED NAME
27 SEPTEMBER	EL SALEEB WINDS	CROSSWINDS
21 OCTOBER	EL SALEEBESH	CRUSADES
26 NOVEMBER	EL MICKNESS	BROOM GALE*
6 DECEMBER	KASSIM	GALE
20 DECEMBER	EL FEDRA/EL SAGHIRA	SMALL FEEDER GALE
11 JANUARY	EL FEDRA	GALE*
19 JANUARY	EL FEDRA/EL KABIRA	LARGE FEEDER GALE
28 JANUARY	EL FEDRA	GALE
18 FEBRUARY	EL SHAMS/EL SAGHIRA	SUN GALE*
10 MARCH	EL HOSSUM	EQUINOX GALE
20 MARCH	EL SHAMS/EL KABIRA	BIG SUN GALE*
25 MARCH	HANA	WIND GALE
29 APRIL	KHAMSEEM WINDS	SAND LADEN S/SW WIND

Each episode generally lasts 3 days.
* - These winds are typically stronger than others.

NOTE: For more detailed information on hazardous weather conditions, see previous Table 2-1 in this section and Hazardous Weather Summary in Section 3.

PORT VISIT INFORMATION

MAY 1990: NOARL Meteorologists R. Fett and R. Miller met with Port Officer and Pilot, Capt. A. Bayada to obtain much of the information included in this port evaluation.

3. GENERAL INFORMATION

This section is intended for Fleet meteorologists/oceanographers and staff planners. Paragraph 3.5 provides a general discussion of hazards and Table 3-1 provides a summary of vessel locations/situations, potential hazards, effect-precautionary/evasive actions, and advance indicators and other information about potential hazards by season.

3.1 Geographic Location

The Port of Limassol is located on the south coast of the island of Cyprus at approximately 34°40'N 33°02'E (Figure 3-1).

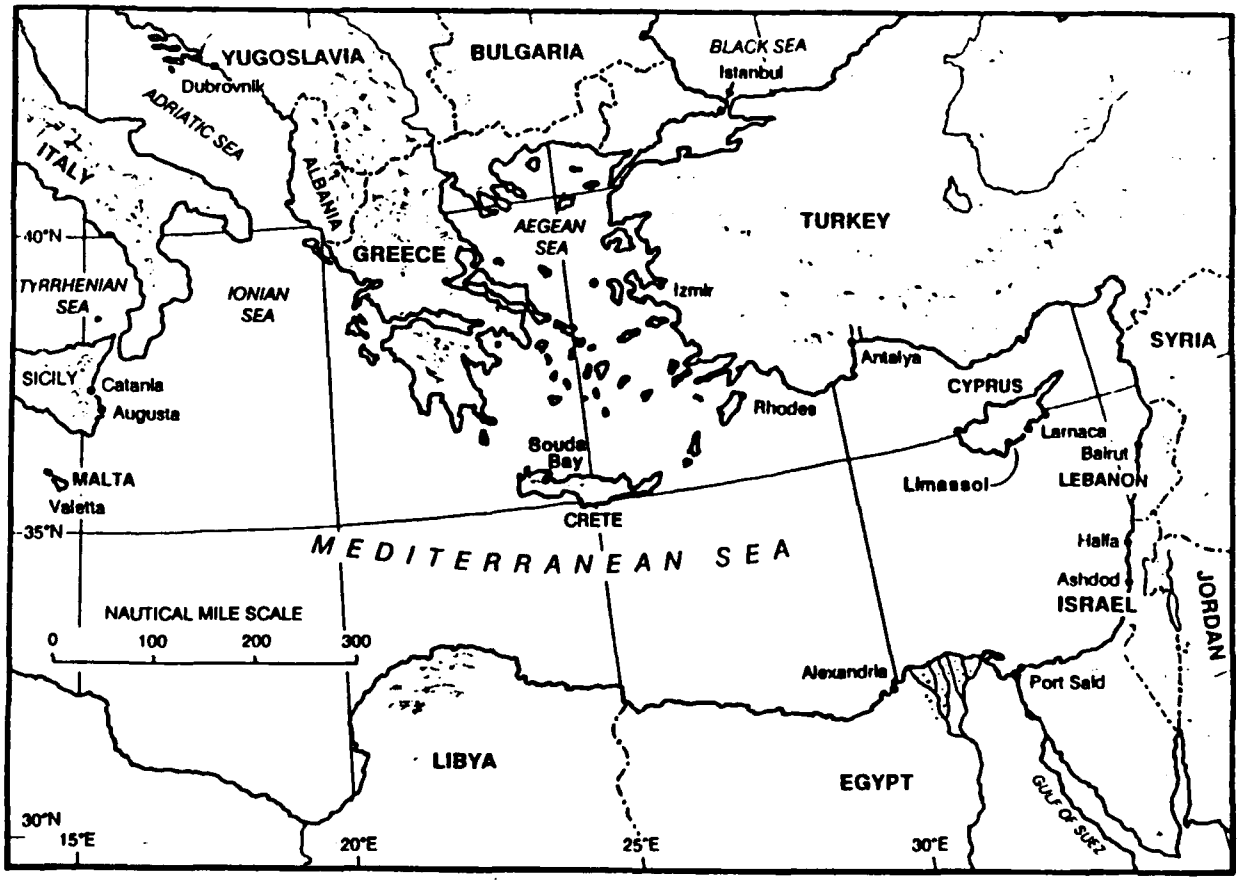

Figure 3-1. Eastern Mediterranean Sea.

The port is situated on the east side of the Akrotiri Peninsula, about 5 n mi north of Cape Gata, the southernmost point on Cyprus (Figure 3-2). The terrain immediately adjacent to Limassol is mostly low-lying, but the Troodos Mountains, with elevations exceeding 5,000 ft (1,524 m), are located north of the port. Elevations over 1,640 ft (500 m) are within 9 n mi of the port. Large salt pans lie southwest of the port on the Akrotiri Peninsula. (Figure 3-2)

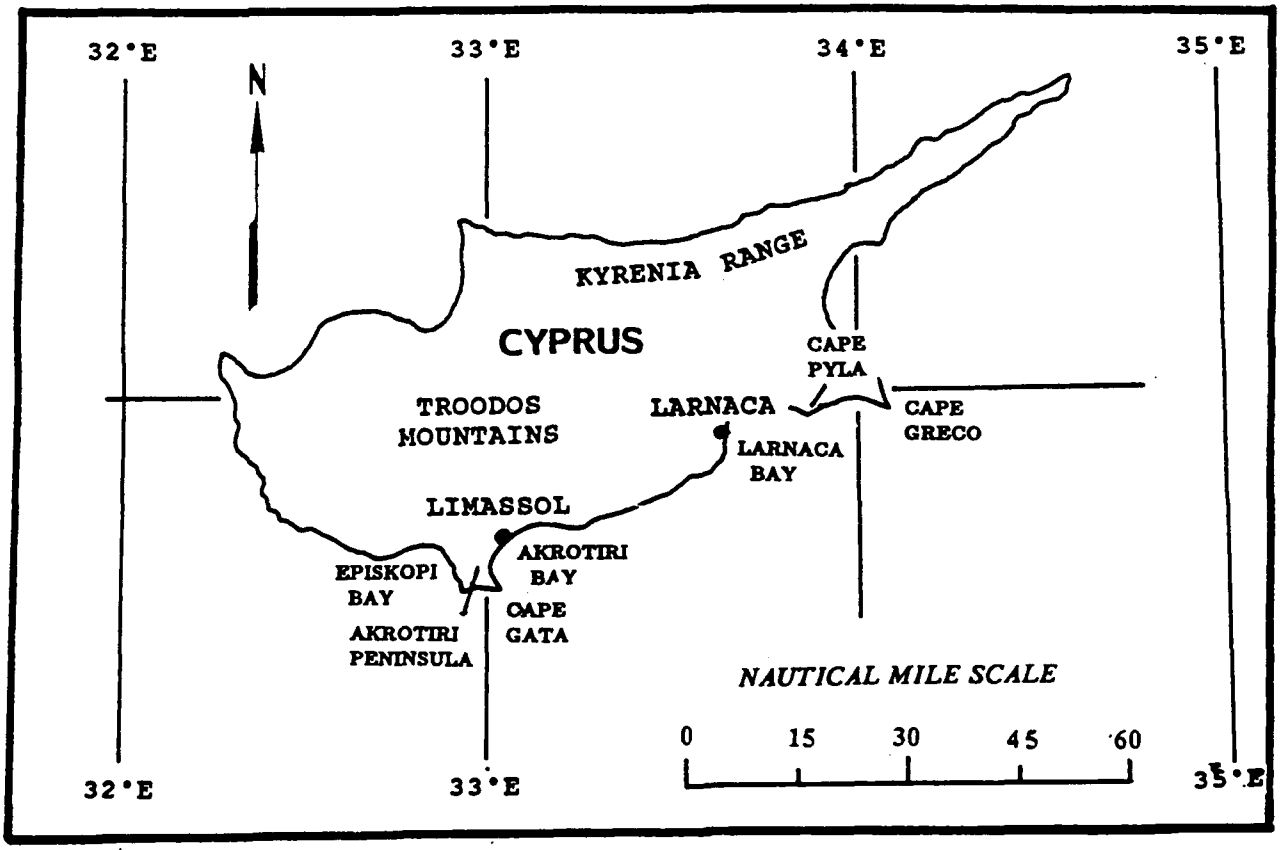

Figure 3-2. Cyprus.

The Port of Limassol is located on the northwest coast of Akrotiri Bay (Figure 3-3). The port is comprised of two harbors and two anchorages. The commercial harbor is the largest, and is capable of handling vessels up to frigate size for berthing in 36 ft (11 m) of water. Berthing is unrestricted, but the harbor is very busy and berthing space may not be available. It is entered through an approach channel which is 39 ft (12 m) deep and 492 ft (150 m) wide between the ends of two breakwaters. A fleet landing is established on the north end of the inner harbor at pier #1. (Figure 3-3)

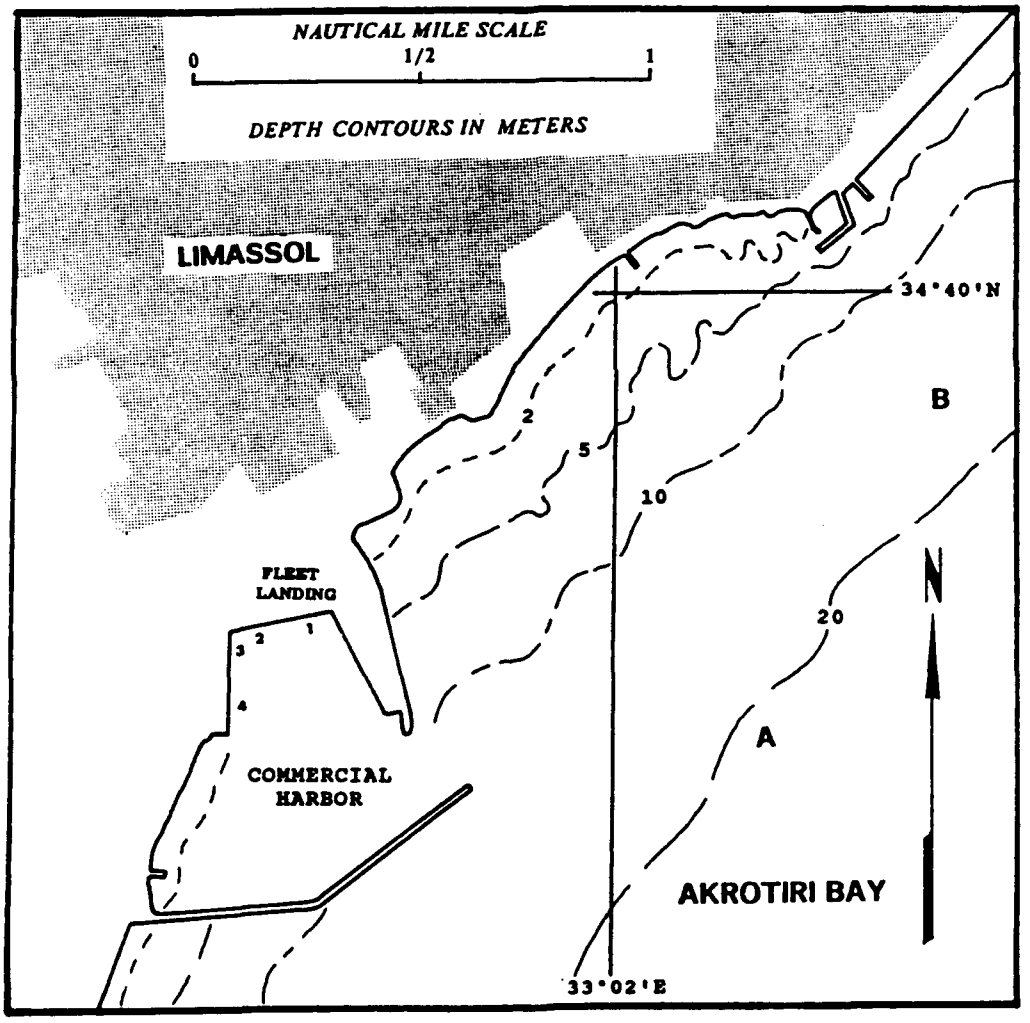

Figure 3-3. Port of Limassol, Cyprus.

A smaller, older harbor is located about 1 1/3 n mi northeast of the commercial harbor. It is used by Navy ships primarily as a fleet landing for small boats from ships utilizing a small-ship anchorage near the harbor. The size of the harbor and shallow depths do not allow larger vessels to enter.

Large vessels, such as aircraft carriers, anchor in an anchorage located about 1 n mi east of the commercial harbor entrance (indicated by the letter "A" in Figure 3-3). Smaller vessels can use the small-ship anchorage located about 1/2 n mi southeast of the smaller harbor (indicated by the letter "B" in Figure 3-3). The small-ship anchorage is very congested, however. Holding in the anchorages is good on a bottom of mud and sand. No anchor dragging has been reported in 17 years for vessels with good ground tackle, even in winds of gale force.

3.2 Qualitative Evaluation of the Port of Limassol

Because of the orientation of the entrance, the commercial harbor offers good protection from waves from most directions. However, steady winds with a strong easterly component can bring waves to 13 ft (4 m) into the harbor. Also, at times, swell will amplify at the harbor entrance. Easterly swell is partially absorbed by a rocky beach, but some reflection occurs in the northeast corner of the harbor. The older harbor is well protected, but small boats may have problems entering during strong easterly winds. During such situations small boats should still be able to enter the commercial harbor.

The anchorages are exposed to winds and waves from northeast clockwise to southwest. Waves may reach 13 ft (4 m) in the anchorages. Heavy swell generated by persistent (2-3 day duration) easterly winds may last up to 20 hours after the wind ceases.

3.3 Currents and Tides

Tides are negligible at Limassol, and currents are wind driven.

3.4 Visibility

Fog is largely a springtime occurrence, with patchy fog reducing visibility to near zero at dawn 3 to 4 times per year. Port operations may be interrupted but the fog usually clears by 0830L. Scirocco events bring dust to the area, but normally is not a problem.

3.5 Hazardous Conditions

The Port of Limassol, including its anchorages, is exposed to heavy weather from the southeast semicircle. Easterly winds, locally called Levante, cause the worst weather in the Port of Limassol. A typical storm brings 35-40 kt winds with a maximum of 50 kt. Although the commercial harbor is protected by breakwaters, easterly swell up to 13 ft (4 m) has entered the harbor, causing damage to moored ships. Easterly swell is partially absorbed by a rocky beach, but some reflection occurs in the northeast corner of the harbor. At times, swell will amplify at the harbor entrance.

The anchorages are fully exposed to easterly swell, with 13 ft (4 m) heights not uncommon. If wind and swell are severe at the anchorages, Episkopi Bay on the west side of the Akrotiri Peninsula provides good shelter from easterly wind and swell. See Figure 3-2.

The predominant wind direction at Limassol is west-southwest, but the Akrotiri Peninsula protects the harbor from any adverse effects from that direction.

Small boats may have problems entering the older harbor during strong easterly winds, but should be able to enter the commercial harbor under the same conditions.

Precipitation occurs on an average of 64 days per year year at Limassol. Figure 3-4 shows the annual distribution of precipitation by average days of occurrence per month per month. Thunderstorms occur during winter months, but generally cause no problems with port operations. Waterspouts are sometimes observed west and south of Limassol, occasionally moving onshore near town.

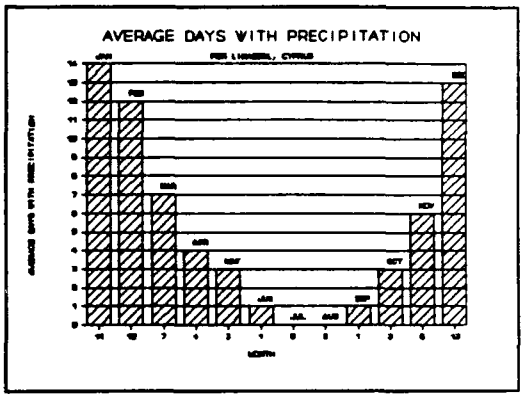

Figure 3-4. Precipitation.

A seasonal summary of various known environmental hazards that may be encountered in the Port of Limassol follows.

A. Winter (November through February)

During the winter season the Eurasian land mass north of the eastern Mediterranean Sea is very cold in comparison to the sea surface temperature near Cyprus. Upper level westerlies are often found over the Mediterranean during this period, resulting in cyclonic activity, unsettled weather and strong winds (Brody and Nestor, 1980).

Local authorities state the most common hazardous weather condition during the winter season is a combination of easterly winds and waves and state that 23 days of stormy weather/easterly winds can be expected per winter. A typical winter storm lasts 2-3 days. A specific cause was not mentioned, but a similar situation that adversely affects Larnaca, about 34 n mi east-northeast of Limassol, is caused by high pressure over Turkey and low pressure to the south near Egypt. The resultant

pressure gradient brings northeast to southeast winds to the Cyprus area.

In an average year, Limassol receives rain on 6 days during November, 13 in December, 14 in January, and 12 in February (see Figure 3-4). Thunderstorms are primarily a wintertime occurrence. Waterspouts are occasionally observed to the west and south, and sometimes move onshore near Limassol.

Brody and Nestor (1980) describes several regional weather phenomena which affect the eastern Mediterranean in general, and consequently have the potential to effect the weather at Limassol during the winter season.

1. Bora. The Bora is a fall wind whose source is so cold that when the air reaches the sea coast, the dynamic warming is insufficient to raise the air temperature to the normal for the region. Although more common along the coast of Yugoslavia, the Bora can occur in the Aegean Sea, mainly during the winter. When it does, it occasionally extends into the eastern Mediterranean near Cyprus. Such an occurrence is associated with cold outbreaks, and depends on the depth of the cold air. If the cold air is shallow (5,000 ft or less) over the Aegean Sea, Bora conditions rarely extend south of Crete. If the cold air is deeper than 5,000 ft, however, the Bora will cross Crete and move into the eastern Mediterranean. The direction of the Bora generally is northerly near Crete, becoming west-northwesterly in the eastern Mediterranean. Because of the protection of the Akrotiri Peninsula, Bora winds do not adversely affect the Port of Limassol. Arriving and departing ships will likely feel the effects of the Bora winds once clear of the protection of Cyprus.

Weather associated with the Bora in the eastern Mediterranean depends on the length of over water trajectory of the cold, initially dry air. Convective cloudiness and some showers can be expected since the cold air has a long overwater track and picks up moisture from the relatively warm water surface.

2. Scirocco. Scirocco is a name given to southeast to southwest winds over the Mediterranean Sea which originate over North Africa. The air's source regions are desert, consequently the Scirocco is extremely dry at its source, warm in winter, and hot in spring and summer. In the eastern Mediterranean, the Scirocco originates over the deserts of Libya and Egypt as well as over the Arabian desert. When the source of the Scirocco is the Arabian desert, the direction of the winds is often southeasterly.

Weather associated with the Scirocco is highly variable depending on the modifications that have occurred over the relatively cool water. By the time the Scirocco reaches the northern portion of the eastern Mediterranean, the air has cooled and collected moisture in its lower layers; thus low stratus, fog and drizzle with reduced visibility are common. Because of a strong surface inversion produced over the water, extremely anomalous radar and radio propagation are likely. Local authorities at Limassol say that Scirocco winds bring dust to the port area but the dust is not a problem.

Heavy rain is likely near frontal boundaries and along topographical barriers. Such barriers would likely include the mountains of Cyprus.

3. Cyprus Depressions. The Cyprus depression develops in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus (Figure 3-1). These cyclones usually become most intense from November through April.

Weather conditions to the west of a Cyprus Depression are typical for the classic case of cold air moving over relatively warm water, i.e., strong-to-gale-force, squally winds with heavy showers. The weather at Limassol would likely be similar to the unstable conditions experienced with a Bora that extends into the eastern Mediterranean. See section 3.5.A.1 above. Scirocco conditions may occur ahead of the developing low

if desert air from the south or southeast is drawn into the circulation.

B. Spring (March through May)

Weather during March and the first part of April is similar to that of winter, but spring is noted for periods of unsettled winter-type weather associated with increased occurrences of North African cyclones; otherwise spring weather is much like summer's (Brody & Nestor, 1980).

Limassol experiences precipitation on an average of 7 days during March, 4 days during April, and 3 days during May (see Figure 3-4).

The Port of Limassol experiences fog during the spring season. Fog may reduce the visibility to near zero at dawn, but it usually clears by 0830L.

Brody and Nestor (1980) describes several regional weather phenomena which affect the eastern Mediterranean in general, and consequently have the potential to effect the weather at Limassol during the spring season.

1. Bora. The Bora is described in section 3.5.A.1 above. Because it is dependent on extremely cold air over the landmass north of the Mediterranean Sea, the Bora threat diminishes rapidly with the progression of the spring season.

2. Scirocco. The Scirocco is described in section 3.5.A.2 above. At some distance from the African coast, which includes the island of Cyprus, the Scirocco occurs most frequently during the cool season, November through April. Consequently, Scirocco occurrences are usually limited to the first month or two of the spring season. During Sciroccos, extremely anomalous radar and radio propagation are likely, especially during spring.

3. Cyprus Depressions. The Cyprus depression develops in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus (Figure 3-1),

and are discussed in section 3.5.A.3 above. These cyclones usually become most intense from November through April, so they are most likely to affect the weather at Limassol during the first part of the spring season.

4. North African Cyclones. The North African cyclones develop over the desert region south of the Atlas Mountains, and are more likely to occur during spring than any other month. These systems usually move northeastward upon reaching the Tunisia/Gulf of Gabes region, but may continue moving eastward just south of the North African coast. Since various tracks are possible, it can be very difficult to forecast when and if a North African cyclone will affect the eastern Mediterranean.

Of special concern to the forecaster in the eastern Mediterranean are the desert depressions that move eastward just south of the North African coast during spring. These systems are hard to track because of the scarcity of timely surface data over North Africa. If the depressions deepen, they are likely to move northeastward. If a North African cyclone moves out over the water, the Scirocco becomes the primary weather phenomenon associated with it. Anomalous radar and radio propagation are likely because of strong low level inversions.

C. Summer (June through September)

The monsoonal effect leads to the development of an intense heat trough over southern Asia that extends westward over Turkey. With higher pressure over the relatively cooler sea surface of the Mediterranean, settled and dry weather with westerly winds persist during the summer (Brody & Nestor, 1980).

Precipitation statistics indicate that rainfall is infrequent during the summer. Records for Limassol show that precipitation occurs on an average of 1 day in June, 0 days in July and August, and only 1 day during September (see Figure 3-4).

Even though most of the more hazardous weather conditions are prominent during the other seasons, some may occur during the summer months. Brody and Nestor (1980) describes several regional weather phenomena which affect the eastern Mediterranean in general, and consequently have the potential to effect the weather at Limassol during the summer season.

1. Etesian. The Etesian is a northerly to westerly wind that occurs during the summer over the Aegean and eastern Mediterranean Seas. In the eastern Mediterranean area, the Etesian occurs as a southeastward extension of the wind regime from the Aegean Sea. The axis of maximum wind passes southeastward through the opening between Rhodes and Crete, and then eastward with reduced strength to the south of Cyprus. The direction of the Etesian in the eastern Mediterranean follows the axis of maximum winds: northwesterlies east of Crete become westerlies south of Cyprus. Gale force Etesians are most likely in the sea area east of Crete, and occur with decreasing frequency southeastward.

Local authorities at Limassol identified a moderate local, westerly wind called "the Provences" that may be, on a greater scale, an Etesian. The Provences "comes from the salt lake" (salt pans) west of the port, according to local mariners. The wind is possibly the effect of a westerly gradient wind passing over the peninsula and being enhanced be the westerly sea breeze. The salt lake would provide a reduced friction region thus keeping the wind strong as it passes over the land. Possibly alluding to the same phemonenon, FICEURLANT (1978) states: "During the summer the prevailing winds sometimes reach gale force in the afternoon making boat work uncomfortable. At such times it is advisable for small vessels to anchor further south."

Etesian weather over the eastern Mediterranean is generally dry with good visibility. Because of the long overwater trajectory of the air, cumulus clouds are likely.

2. Scirocco. Scirocco conditions are discussed in section 3.5.A.2 above. Although it is possible to

experience a Scirocco during the summer, a significant event would be unusual.

3. Cyprus Depressions. The Cyprus depression develops in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus (Figure 3-1). These cyclones are most intense from November through April, so although summer occurrences are possible, they do not usually pose any significant threat to the Port of Limassol.

D. Autumn (October)

The autumn season in the Mediterranean area is short, usually lasting only for the month of October. It is characterized by an abrupt change from the relatively subdued summer weather to the unsettled weather of winter. By the end of the month, the extratropical storm track has moved southward from its summertime location over Europe, and extratropical storms again transit the Mediterranean region. The threat of strong northeast to southeast winds increases as the month progresses. Hazardous weather conditions which may be expected by the end of the month are described in section 3.5.A above.

Precipitation frequency starts to increase by the end of the month. Records for Limassol indicate that rain can be expected on an average of 3 days during the month of October (see Figure 3-4).

3.6 Harbor Protection

As detailed below, the Port of Limassol is a relative safe port under most weather conditions, but caution is advised with strong easterly winds and waves.

3.6.1 Wind and Weather

The Port of Limassol offers little protection from wind and waves from the southeast semicircle. Wind effects could be

reduced by moored ships in the commercial harbor by doubling or adding lines as necessary.

Anchored vessels in both anchorages are exposed to the full effects of wind and waves from the southeast semicircle. Northeast gales occur from October to April and during these months it is advisable to anchor in about 72 ft (22 m) of water. During the summer the prevailing winds sometimes reach gale force (34 kt) in the afternoon making boat work uncomfortable. At such times it is advisable for small vessels to anchor farther south (FICEURLANT, 1978).

Although not specifically mentioned during the port visit, the Troodos Mountains north of Limassol would effectively prevent any significant northerly wind from reaching the port.

Thunderstorms are primarily a wintertime phenomenon, and cause no significant operations problem in the port. Waterspouts are observed to the west and south, and occasionally come onshore near Limassol.

3.6.2 Waves

The inner harbor is vulnerable to swell from the east. On one occurrence, steady 35 kt winds lasted 17 hours and 13 ft (4 m) waves entered the inner harbor, damaging some ships. Easterly swell is partially absorbed by a rocky beach but some reflection occurs in the northeast corner of the harbor. In some circumstances, swell will amplify at the harbor entrance.

A typical winter storm lasts 2-3 days and causes 7-8 ft (2 to 2 1/2 m) waves in the anchorages. Swell to 13 ft (4 m) is possible, but vessels with good ground tackle normally do not drag anchor with winds of gale force.

3.7 Protective and Mitigating Measures

3.7.1 Moving to a New Anchorage

Holding on the mud and sand bottom is good, and no anchor dragging has been reported in 17 years. But if conditions are severe, Episkopi Bay on the west side of the Akrotiri Peninsula provides good shelter from easterly wind and swell.

3.8 Local Indicators of Hazardous Weather Conditions

An indicator of approaching strong easterly winds (the worst weather condition for the port) is a lowering of the water level in the harbor by 8-12 inches (20-30 cm). This phenomenon can cause a problem for berthed ships with drafts near 33 ft (10 m) because the depths in the harbor have been dredged to only 36 ft (11 m). Meteorologists should also be alert to watch for building high pressure over Turkey with lower pressure over Egypt in order to anticipate the onset of northeast to southeast winds and waves.

The Phoenician Wind Prediction Calendar, included at the end of this section, may be of use in anticipating other wind events.

In addition to the foregoing, the following rules, which have been taken from Brody and Nestor (1980), give some insight to the development of hazardous weather conditions at Limassol.

Etesian winds - During a gale force Etesian over the Aegean Sea, the axis of maximum winds passes south-eastward through the opening between Rhodes and Crete into the eastern Mediterranean Sea. The strength of the Etesian diminishes downwind, and south of Cyprus its direction becomes westerly.

Scirocco - A good indication of the start of a Scirocco in the eastern Mediterranean is the development of strong southerly winds at stations along the NE coast of Libya.

Haze - Salt haze is a serious problem for flight operations over the Mediterranean. This haze has the following characteristics:

1. It is most prevalent during the summer and early autumn.

2. Its color is bluish white, as opposed to the brown of dust haze.

3. Salt haze scatters and reflects light rays much more than does dust haze.

4. Salt haze sometimes extends to over 12,000 ft and has been reported up to 20,000 ft.

5. Although surface visibility in salt haze may be as high as 4-6 n mi, the slant visibility for a pilot making a landing approach may be near zero, especially if the approach is in the general direction of the sun.

6. Salt haze is sometimes thicker aloft than at the surface.

7. Salt haze is less of a problem after sunset since the poor visibility is caused partially by scattering and reflection.

Salt haze is most likely to develop in a stagnant air mass when there is a lack of mixing. It is especially prevalent when there is a strong ridge present at the surface and aloft. It will not completely disperse until there is a change of air masses such as occurs with a frontal passage. Visibility will improve if there is an increase in the wind speeds at the 850 and/or 700 mb levels.

Miscellaneous

1. Gale force northwesterlies occur in the eastern Mediterranean as an extension of the Bora in the Aegean Sea if the cold air is deep (greater than 5,000 ft). Shallow cold air will not extend south of Crete and therefore will not affect the eastern Mediterranean.

2. If summer winds are calm near Cyprus and stronger winds are sought for carrier operations:

a. A day breeze can be found close inshore off Akrotiri (near the south tip of the Akrotiri Peninsula) even when winds are calm 15 n mi offshore.

b. A night wind can be found about 40 n mi southwest of Cape Gata.

3. Cyprus depressions usually form in the late autumn or early spring when a deep stream of cold air moves toward the eastern Mediterranean from the Balkans or the Black Sea.

4. Cyclogenesis can be expected to begin in the Cyprus area when a cold front approaches the Anatolian plateau (in central Turkey) from the north.

5. Strong surface ridging eastward across Morocco is an indication that a North African cyclone will move/develop over Tunisia, east of the Atlas Mountains. If surface winds at Algiers shift from southwesterly to northwesterly in association with the ridging, cyclogenesis will occur east of the Atlas Mountains.

6. Cyclones developing on the southern edge of a cold surge over the Aegean Sea may move southward or even southwestward at first, but normally they later will move eastward to the Cyprus area.

7. The strongest winds associated with a deepening North African low, after the system moves out over the Mediterranean, occur in the northwest sector of the system rather than in the eastern sector.

8. Wind speeds at coastal stations in Israel and Cyprus are not good indicators of the wind strength at sea during periods of strong westerly flow in the eastern Mediterranean.

The visit to the Port of Limassol produced a "Phoenician Wind Prediction Calendar" which is used locally to predict the onset of various wind events. The calendar is reported to be 90% successful. According to local authorities if wind does not occur, it is late, not absent. A copy of the calendar is included below.

PHONECIAN WIND PREDICTION CALENDAR

APPROX. DATE	LOCAL NAME	TRANSLATED NAME
27 SEPTEMBER	EL SALEEB WINDS	CROSSWINDS
21 OCTOBER	EL SALEEBESH	CRUSADES
26 NOVEMBER	EL MICKNESS	BROOM GALE*
6 DECEMBER	KASSIM	GALE
20 DECEMBER	EL FEDRA/EL SAGHIRA	SMALL FEEDER GALE
11 JANUARY	EL FEDRA	GALE*
19 JANUARY	EL FEDRA/EL KABIRA	LARGE FEEDER GALE
28 JANUARY	EL FEDRA	GALE
18 FEBRUARY	EL SHAMS/EL SAGHIRA	SUN GALE*
10 MARCH	EL HOSSUM	EQUINOX GALE
20 MARCH	EL SHAMS/EL KABIRA	BIG SUN GALE*
25 MARCH	HANA	WIND GALE
29 APRIL	KHAMSEEM WINDS	SAND LADEN S/SW WINDS

Each episode generally lasts 3 days.
* - These winds are typically stronger than others.

3.9 Summary of Problems, Actions, and Indicators

Table 3-1 is intended to provide easy-to-use seasonal references for meteorologists on ships using the Port of Limassol. Table 2-1 (Section 2) summarizes Table 3-1 and is intended primarily for use by ship captains.

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Table 3-1. Potential problem situations at th

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUTIONA
1. Moored-Commercial Harbor. Strongest in Winter & early Spring Uncommon in Summer & early Autumn	a. E'ly winds/waves, called levante - Creates the worst weather conditions at the port. Typical storm brings 35-40 kt winds, maximum 50 kt. Inner harbor has experienced swell to 13 ft (4 m), causing damage to ships. Swell is partially absorbed by rocky beach, but some reflection occurs in NE corner of harbor. At times, swell amplifies at harbor entrance.	a. Worst conditions for vessels should monitor we water level to see if str and double/add mooring li effects of wind force and harbor.
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	b. Scirocco winds - Warm SE to SW wind originating in deserts of N Africa. Associated weather may include low stratus, fog and drizzle with reduced visibility. Also may bring dust, but dust causes no problems at the port. Heavy rain is likely near frontal boundaries and topographical barriers such as the mountains of Cyprus.	b. Minimal impact on the protected except against monitor weather forecasts are expected and double/a quired. Extremely anomal agation may be experience level inversion.
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	c. Cyprus depressions - Generally form between Turkey and Cyprus. Most intense November through April. Associated weather includes strong-to-gale force, squally winds with heavy showers.	c. The potential for str heavy showers exists in t conditions should not adv vessels.

Table 3-1. Potential problem situations at the Port of Limassol, Cyprus - ALL SEASONS

TENTIAL HAZARD	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS ABOUT POTENT
winds/waves, called - Creates the worst conditions at the port. storm brings 35-40 kt aximum 50 kt. Inner as experienced swell to m), causing damage to Swell is partially by rocky beach, but ection occurs in NE harbor. At times, olifies at harbor en-	a. Worst conditions for port in general. Moored vessels should monitor weather forecasts and watch water level to see if strong winds are expected and double/add mooring lines as required to reduce effects of wind force and possible swell waves in harbor.	a. The winds are caused Turkey and coincident lo Egypt, which results in gradient over Cyprus. be reviewed with this sc
cco winds - Warm SE to riginating in deserts ca. Associated weath- clude low stratus, fog le with reduced visi- Also may bring dust, causes no problems at Heavy rain is likely cal boundaries and ical barriers such as ains of Cyprus.	b. Minimal impact on the harbor since it is well protected except against wind. Vessels should monitor weather forecasts to see if strong winds are expected and double/add mooring lines as required. Extremely anomalous radar and radio propagation may be experienced due to a strong low level inversion.	b. In the E Mediterrane nates to the S over the Egypt, and over the Arab When the source is the A tion of the scirocco is distance from the N Afri occur most frequently du period and are usually f develop either over the or near Cyprus. See Cyp 1.c below. A good indic Scirocco in the E Medite of strong S'ly winds at coast of Libya.
depressions - Gener- between Turkey and fost intense November pril. Associated cludes strong-to-gale ially winds with heavy	c. The potential for strong, gusty winds and heavy showers exists in the harbor, but overall conditions should not adversely affect moored vessels.	c. Cyprus depressions d Taurus Mountains of Turk from the Gulf of Antalya develop during any seaso intense from November th associated with the deve Cyprus depression includ (1) The thermal co water. (2) Interaction be stream and the subtropic (3) Effect of N'ly of Turkey enhancing cycl the southern slopes. (4) Topographic fe fronts' S movement. Cyclones also form Sea of Crete. If one fo of a significant cold su SW at first, but later i track to the Cyprus area

?Y/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
ɔrt in general. Moored :her forecasts and watch ıg winds are expected ɛs as required to reduce ɔossible swell waves in	a. The winds are caused by high pressure over Turkey and coincident low pressure to the S near Egypt, which results in a strengthened pressure gradient over Cyprus. Prognostic charts should be reviewed with this scenario in mind.
ıarbor since it is well .nd. Vessels should :o see if strong winds mooring lines as re- ıs radar and radio prop- due to a strong low	b. In the E Mediterranean, the Scirocco originates to the S over the deserts of Libya and Egypt, and over the Arabian desert to the SE. When the source is the Arabian desert, the direction of the scirocco is often SE'ly. At some distance from the N African coast, Scirocco events occur most frequently during the November-April period and are usually found E of cyclones that develop either over the S Aegean Sea/Sea of Crete or near Cyprus. See Cyprus Depressions in section 1.c below. A good indication of the start of a Scirocco in the E Mediterranean is the development of strong S'ly winds at stations along the NE coast of Libya.
ıg, gusty winds and harbor, but overall ɪsely affect moored	c. Cyprus depressions develop in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus. They can develop during any season, but usually become most intense from November through April. Factors associated with the development of an intense Cyprus depression include: (1) The thermal contrast between land and water. (2) Interaction between the polar front jet stream and the subtropical jet stream. (3) Effect of N'ly flow over the mountains of Turkey enhancing cyclogenetic activity along the southern slopes. (4) Topographic features blocking cold fronts' S movement. Cyclones also form over the S Aegean Sea and Sea of Crete. If one forms along the leading edge of a significant cold surge, it may move S or even SW at first, but later it will take a more E'ly track to the Cyprus area.

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUTIO
Possible in Winter Most common in Spring Uncommon in Summer Possible in Autumn	d. N African cyclones - Low pressure systems which develop over N Africa. Primary weather concern is development of Scirocco conditions (i.e. low stratus, fog and drizzle with reduced visibility) in S'ly flow on E side of system.	d. The major impact on ited to effects similar outlined in 1.b above. propagation may be expe:
2. Anchored. Strongest in Winter & early Spring Uncommon in Summer & early Autumn	a. E-'ly winds/waves, called levante - Creates the worst weather conditions at the port. Typical storm brings 35-40 kt winds, maximum 50 kt. Waves at the anchorage may reach 13 ft (4 m) and last for 20 hours after wind stops.	a. Worst conditions fo is good on a mud and sa anchor dragging has bee vessels with good groun gale force. If conditi Bay west of Akrotiri Pe ter from E wind and swe
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	b. Scirocco winds - Warm SE to SW wind originating in deserts of N Africa. Associated weather may include low stratus, fog and drizzle with reduced visibility. Also may bring dust, but dust causes no problems at the port. Heavy rain is likely near frontal boundaries and topographical barriers such as the mountains of Cyprus.	b. Minimal effect. A raise waves to 8 ft in pose no problem for anc anomalous radar and rad rienced.
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	c. Cyprus depressions - Generally form between Turkey and Cyprus. Most intense November through April. Associated weather includes strong-to-gale force, squally winds with heavy showers.	c. Ships should be awa strong, gusty winds an wise, few problems shou

Table 3-1. (Continued)

NTIAL HAZARD	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS A ABOUT POTENTI
can cyclones - Low ystems which develop ica. Primary weather development of Sci- itions (i.e. low g and drizzle with sibility) in S'ly ide of system.	d. The major impact on harbor operations is limited to effects similar to those of a Scirocco as outlined in 1.b above. Anomalous radar and radio propagation may be experienced.	d. N African cyclones d region S of the Atlas Mo move NE upon reaching th region, but may continue African coast. Since va it can be very difficult N African cyclone will a Of special concern to th Mediterranean are the de E just S of the N Africa The systems are hard to city of timely surface d depressions deepen, they
inds/waves, called reates the worst ditions at the port. rm brings 35-40 kt mum 50 kt. Waves at ge may reach 13 ft ast for 20 hours stops.	a. Worst conditions for the anchorages. Holding is good on a mud and sand bottom, however, and no anchor dragging has been reported in 17 years for vessels with good ground tackle, even in winds of gale force. If conditions are severe, Episkopi Bay west of Akrotiri Peninsula provides good shelter from E wind and swell.	a. The winds are caused Turkey and coincident lo Egypt, which results in gradient over Cyprus. reviewed with this scena
o winds - Warm SE to ginating in deserts . Associated weath- ude low stratus, fog with reduced visi- so may bring dust, uses no problems at Heavy rain is likely l boundaries and al barriers such as ns of Cyprus.	b. Minimal effect. A steady wind of 20 kt could raise waves to 8 ft in the anchorage but should pose no problem for anchored ships. Extremely anomalous radar and radio propagation may be experienced.	b. In the E Mediterranea nates to the S over the Egypt, and over the Arab When the source is the A tion of the Scirocco is distance from the N Afri occur most frequently du period and are usually f develop either over the or near Cyprus. See Cyp 1.c below. A good indic Scirocco in the E Medite of strong S'ly winds at coast of Libya.
depressions - Gener- etween Turkey and st intense November l. Associated ludes strong-to-gale ly winds with heavy	c. Ships should be aware of possibility of strong, gusty winds and heavy showers. Otherwise, few problems should be experienced.	c. Cyprus depressions d Taurus Mountains of Turk from the Gulf of Antalya develop during any seaso intense from November th associated with the deve Cyprus depression includ (1) The thermal co water. (2) Interaction bet stream and the subtropic (3) Effect of N'ly of Turkey enhancing cycl the southern slopes. (4) Topographic fea fronts' S movement. Cyclones also form c Sea of Creta. If one fo of a significant cold su SW at first, but later i track to the Cyprus area

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) O HA	RY/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
elop tain Tuni ovir ous o fo ect fore rt o coas ack a ov re I	bor operations is lim- those of a Scirocco as malous radar and radio ced.	d. N African cyclones develop over the desert region S of the Atlas Mountains. They usually move NE upon reaching the Tunisia/Gulf of Gabes region, but may continue moving E just S of the N African coast. Since various tracks are possible, it can be very difficult to forecast when and if a N African cyclone will affect the E Mediterranean. Of special concern to the forecaster in the E Mediterranean are the desert depressions that move E just S of the N African coast during spring. The systems are hard to track because of the scarcity of timely surface data over N Africa. If the depressions deepen, they are likely to move NE.
y hi pres stre gnos o in	e anchorages. Holding ottom, however, and no eported in 17 years for ckle, even in winds of are severe, Episkopi ula provides good shel-	a. The winds are caused by high pressure over Turkey and coincident low pressure to the S near Egypt, which results in a strengthened pressure gradient over Cyprus. Prognostic charts should be reviewed with this scenario in mind.
th ert de ian en co g t d E ege De on near tio	dy wind of 20 kt could anchorage but should d ships. Extremely ropagation may be expe-	b. In the E Mediterranean, the Scirocco originates to the S over the deserts of Libya and Egypt, and over the Arabian desert to the SE. When the source is the Arabian desert, the direction of the Scirocco is often SE'ly. At some distance from the N African coast, Scirocco events occur most frequently during the November-April period and are usually found E of cyclones that develop either over the S Aegean Sea/Sea of Crete or near Cyprus. See Cyprus Depressions in section 1.c below. A good indication of the start of a Scirocco in the E Mediterranean is the development of strong S'ly winds at stations along the NE coast of Libya.
lop in Cy but gh ment ast en t jet ow o neti res : th alo , it ill	f possibility of vy showers. Other- e experienced.	c. Cyprus depressions develop in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus. They can develop during any season, but usually become most intense from November through April. Factors associated with the development of an intense Cyprus depression include: (1) The thermal contrast between land and water. (2) Interaction between the polar front jet stream and the subtropical jet stream. (3) Effect of N'ly flow over the mountains of Turkey enhancing cyclogenetic activity along the southern slopes. (4) Topographic features blocking cold fronts' S movement. Cyclones also form over the S Aegean Sea and Sea of Crete. If one forms along the leading edge of a significant cold surge, it may move S or even SW at first, but later it will take a more E'ly track to the Cyprus area.

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUTI
Uncommon in Winter Most common in Summer, late Spring & early Autumn	d. Etesian winds - A N'ly to W'ly wind which occurs over the Aegean and E Mediterranean Seas. Local effect at Port of Limassol is a moderate W wind called "the Provences" that blows across the salt pans W of the port, sometimes reaching gale force in the afternoons.	d. Strong afternoon w fortable. At such ti small vessels to ancho
Possible in Winter Most common in Spring Uncommon in Summer Possible in Autumn	e. N African cyclones - Low pressure systems which develop over N Africa. Primary weather concern is development of Scirocco conditions (i.e. low stratus, fog and drizzle with reduced visibility) in S'ly flow on E side of system.	e. Minimal effect unl than normal winds to t of 20 kt could raise w age but should pose no Anomalous radar and ra rienced.
3. Arriving/ Departing. Strongest in Winter & early Spring Uncommon in Summer & early Autumn	a. NE-SE'ly winds/waves - Creates the worst weather conditions at the port. Caused by high pressure over Turkey and low pressure over/near Egypt. Typical storm brings 35-40 kt winds, maximum 50 kt. Inner harbor has experienced swell to 13 ft (4 m), causing damage to ships. Swell is partially absorbed by rocky beach, but some reflection occurs in NE corner of harbor. At times, swell amplifies at harbor entrance. Waves at the anchorage may reach 13 ft (4 m) and last for 20 hours after wind stops.	a. Worst conditions fo ing vessels should moni see if strong winds are mooring lines as requi wind force and possible doubling/ adding moori ing in the anchorages bottom and no anchor d 17 years for vessels wi in winds of gale force. Episkopi Bay west of A good shelter from E wi
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	b. Bora winds - A fall wind commonly occurring over the Ionian and Aegean Seas. A strong, deep event may extend SE from the Aegean Sea and reach the E Mediterranean. Direction is WNW in the E Mediterranean generally, and W near Cyprus.	b. Minimal effect at conditions S of the po and waves raised by th vessels should expect of the protection of A

Table 3-1. (Continued)

ARY TIAL HAZARD	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS A ABOUT POTENTIA
s ma it arth winds - A N'ly to hich occurs over the E Mediterranean effect at Port of a moderate W wind Provences" that s the salt pans W of ometimes reaching in the afternoons.	d. Strong afternoon winds make boat work uncomfortable. At such times it is advisable for small vessels to anchor farther south.	d. In the E Mediterrane curs as a SE extension o Aegean Sea. The maximum through the opening betw then E with reduced stre direction of the etesian follows the axis of maxi Crete become west S of C
eve port s to roble pro an cyclones - Low stems which develop ea. Primary weather levelopment of Sci- ions (i.e. low and drizzle with bility) in S'ly de of system.	e. Minimal effect unless event brings stronger than normal winds to the port. Sustained winds of 20 kt could raise waves to 8 ft in the anchorage but should pose no problem for anchored ships. Anomalous radar and radio propagation may be experienced.	e. N African cyclones de region S of the Atlas Mo move NE upon reaching the region, but may continue African coast. Since va it can be very difficult N African cyclone will a Of special concern to the Mediterranean are the des E just S of the N Africa The systems are hard to city of timely surface da depressions deepen, they
port r we xpec to well line good ging goo If c tiri and winds/waves - worst weather con- he port. Caused by e over Turkey and over/near Egypt. m brings 35-40 kt um 50 kt. Inner xperienced swell to causing damage to l is partially rocky beach, but ion occurs in NE rbor. At times, ies at harbor en- es at the anchorage ft (4 m) and last after wind stops.	a. Worst conditions for port in general. Incoming vessels should monitor weather forecasts to see if strong winds are expected and double/add mooring lines as required to mitigate effects of wind force and possible swell waves in harbor by doubling/ adding mooring lines as required. Holding in the anchorages is good on a mud and sand bottom and no anchor dragging has been reported in 17 years for vessels with good ground tackle, even in winds of gale force. If conditions are severe, Episkopi Bay west of Akrotiri Peninsula provides good shelter from E wind and swell.	a. The winds are caused Turkey and coincident low Egypt, which results in a gradient over Cyprus. Pr reviewed with this scenar
por woul ora vier tiri is - A fall wind rring over the egean Seas. A event may extend egean Sea and editerranean. WNW in the E Medi- erally, and W near	b. Minimal effect at the port, but open ocean conditions S of the port would be exposed to winds and waves raised by the Bora event. Departing vessels should expect heavier weather when clear of the protection of Akrotiri Peninsula.	b. The Bora is a fall w cold that, when the air dynamic warming is insuf temperature to the norma While most common along the Ionian Sea, it also Sea. It is this latter sometime extend into the measure of the probable is the depth of the cold less then 5,000 ft deep, extend S of the island o the cold air depth excee most likely extend over

ed)

ONARY/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
nds make boat work uncom- es it is advisable for farther south.	d. In the E Mediterranean area, the etesian occurs as a SE extension of the wind regime from the Aegean Sea. The maximum winds axis passes SE through the opening between Rhodes and Crete, and then E with reduced strength S of Cyprus. The direction of the etesian in the E Mediterranean follows the axis of maximum winds: NW winds E of Crete become west S of Cyprus.
ss event brings stronger e port. Sustained winds ves to 8 ft in the anchor- problem for anchored ships. io propagation may be expe-	e. N African cyclones develop over the desert region S of the Atlas Mountains. They usually move NE upon reaching the Tunisia/Gulf of Gabes region, but may continue moving E just S of the N African coast. Since various tracks are possible, it can be very difficult to forecast when and if a N African cyclone will affect the E Mediterranean. Of special concern to the forecaster in the E Mediterranean are the desert depressions that move E just S of the N African coast during spring. The systems are hard to track because of the scarcity of timely surface data over N Africa. If the depressions deepen, they are likely to move NE.
port in general. Incom- or weather forecasts to expected and double/add d to mitigate effects of swell waves in harbor by lines as required. Hold- good on a mud and sand gging has been reported in h good ground tackle, even If conditions are severe, otiri Peninsula provides and swell.	a. The winds are caused by high pressure over Turkey and coincident low pressure to the S near Egypt, which results in a strengthened pressure gradient over Cyprus. Prognostic charts should be reviewed with this scenario in mind.
e port, but open ocean would be exposed to winds Bora event. Departing avier weather when clear otiri Peninsula.	b. The Bora is a fall wind whose source is so cold that, when the air reaches the coast, the dynamic warming is insufficient to raise the air temperature to the normal level for the region. While most common along the Yugoslavian coast on the Ionian Sea, it also occurs over the Aegean Sea. It is this latter occasion when the winds sometime extend into the E Mediterranean Sea. One measure of the probable extent of such Bora winds is the depth of the cold air. If the cold air is less then 5,000 ft deep, Bora conditions rarely extend S of the island of Crete. Conversely, if the cold air depth exceeds 5,000 ft, the Bora will most likely extend over the E Mediterranean Sea.

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUT
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	c. Scirocco winds - Warm SE to SW wind originating in deserts of N Africa. Associated weather may include low stratus, fog and drizzle with reduced visibility. Also may bring dust, but dust causes no problems at the port. Heavy rain is likely near frontal boundaries and topographical barriers such as the mountains of Cyprus.	c. Minimal impact on protected except agai vessels should monito if strong winds are e ing lines as required could raise waves to should pose no proble tremely anomalous rad be experienced due to sion.
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	d. Cyprus depressions - Generally form between Turkey and Cyprus. Most intense November through April. Associated weather includes strong-to-gale force, squally winds with heavy showers.	d. The potential for heavy showers exists conditions should not outgoing vessels.
Uncommon in Winter Most common in Summer, late Spring & early Autumn	e. Etesian winds - A N'ly to W'ly wind which occurs over the Aegean and E Mediterranean Seas. Local effect at Port of Limassol is a moderate W wind called "the Provences" that blows across the salt pans W of the port, sometimes reaching gale force in the afternoons.	e. Strong afternoon fortable. At such t small vessels to anch Open ocean conditions posed to winds and wa event. Departing ves weather when clear of Akrotiri Peninsula.
Possible in Winter Most common in Spring Uncommon in Summer Possible in Autumn	f. N African cyclones - Low pressure systems which develop over N Africa. Primary weather concern is development of Scirocco conditions (i.e. low stratus, fog and drizzle with reduced visibility) in S'ly flow on E side of system.	f. The major impact ited to effects simil outlined in 3.c above propagation is possib

Table 3-1. (Continued)

:NTIAL HAZARD	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS AN ABOUT POTENTIAL
:co winds - Warm SE to riginating in deserts :a. Associated weath- :lude low stratus, fog le with reduced visi- lso may bring dust, :auses no problems at Heavy rain is likely :al boundaries and ical barriers such as ains of Cyprus.	c. Minimal impact on the harbor since it is well protected except against wind force. Incoming vessels should monitor weather broadcasts to see if strong winds are expected and double/add mooring lines as required. A steady wind of 20 kt could raise waves to 8 ft in the anchorage but should pose no problem for anchored ships. Extremely anomalous radar and radio propagation may be experienced due to a strong low level inversion.	c. In the E Mediterranean nates to the S over the de Egypt, and over the Arabia When the source is the Ara tion of the Scirocco is of distance from the N Africa occur most frequently duri period and are usually fou develop either over the S or near Cyprus. See Cypru 1.c below. A good indicat Scirocco in the E Mediterr of strong S'ly winds at st coast of Libya.
us depressions - Gener- n between Turkey and Most intense November April. Associated includes strong-to-gale qually winds with heavy	d. The potential for strong, gusty winds and heavy showers exists in the harbor, but overall conditions should not adversely affect incoming or outgoing vessels.	d. Cyprus depressions dev Taurus Mountains of Turkey from the Gulf of Antalya t develop during any season, intense from November thro associated with the develo Cyprus depression include: (1) The thermal cont water. (2) Interaction betw stream and the subtropical (3) Effect of N'ly f of Turkey enhancing cyclog the southern slopes. (4) Topographic feat fronts' S movement. Cyclones also form ov Sea of Crete. If one form of a significant cold surg SW at first, but later it track to the Cyprus area.
an winds - A N'ly to which occurs over the d E Mediterranean cal effect at Port of is a moderate W wind he Provences" that oss the salt pans W of sometimes reaching e in the afternoons.	e. Strong afternoon winds make boat work uncomfortable. At such times it is advisable for small vessels to anchor farther south. Open ocean conditions S of the port would be exposed to winds and waves created by the etesian event. Departing vessels should expect heavier weather when clear of the protection of the Akrotiri Peninsula.	e. In the E Mediterranean curs as a SE extension of Aegean Sea. The maximum w through the opening betwee then E with reduced streng direction of the etesian i follows the axis of maximu Crete become W, S of Cypru
can cyclones - Low ystems which develop ica. Primary weather development of Sci- litions (i.e. low og and drizzle with sibility) in S'ly side of system.	f. The major impact on harbor operations is limited to effects similar to those of a scirocco as outlined in 3.c above. Anomalous radar and radio propagation is possible.	f. N African cyclones dev region S of the Atlas Mour move NE upon reaching the region, but may continue n African coast. Since vari it can be very difficult t N African cyclone will aff Of special concern to the Mediterranean are the dese E just S of the N African The systems are hard to tr city of timely surface dat depressions deepen, they a

(Continued)

NARY/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
e harbor since it is well wind force. Incoming eather broadcasts to see cted and double/add moor- A steady wind of 20 kt t in the anchorage but or anchored ships. Ex- and radio propagation may strong low level inver-	c. In the E Mediterranean, the Scirocco originates to the S over the deserts of Libya and Egypt, and over the Arabian desert to the SE. When the source is the Arabian desert, the direction of the Scirocco is often SE'ly. At some distance from the N African coast, Scirocco events occur most frequently during the November-April period and are usually found E of cyclones that develop either over the S Aegean Sea/Sea of Crete or near Cyprus. See Cyprus Depressions in section 1.c below. A good indication of the start of a Scirocco in the E Mediterranean is the development of strong S'ly winds at stations along the NE coast of Libya.
rong, gusty winds and the harbor, but overall versely affect incoming or	d. Cyprus depressions develop in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus. They can develop during any season, but usually become most intense from November through April. Factors associated with the development of an intense Cyprus depression include: (1) The thermal contrast between land and water. (2) Interaction between the polar front jet stream and the subtropical jet stream. (3) Effect of N'ly flow over the mountains of Turkey enhancing cyclogenetic activity along the southern slopes. (4) Topographic features blocking cold fronts' S movement. Cyclones also form over the S Aegean Sea and Sea of Crete. If one forms along the leading edge of a significant cold surge, it may move S or even SW at first, but later it will take a more E'ly track to the Cyprus area.
ds make boat work uncom- s it is advisable for farther south. of the port would be ex- created by the etesian s should expect heavier e protection of the	e. In the E Mediterranean area, the etesian occurs as a SE extension of the wind regime from the Aegean Sea. The maximum winds axis passes SE through the opening between Rhodes and Crete, and then E with reduced strength S of Cyprus. The direction of the etesian in the E Mediterranean follows the axis of maximum winds: NW winds E of Crete become W, S of Cyprus.
harbor operations is lim- to those of a scirocco as Anomalous radar and radio	f. N African cyclones develop over the desert region S of the Atlas Mountains. They usually move NE upon reaching the Tunisia/Gulf of Gabes region, but may continue moving E just S of the N African coast. Since various tracks are possible, it can be very difficult to forecast when and if a N African cyclone will affect the E Mediterranean. Of special concern to the forecaster in the E Mediterranean are the desert depressions that move E just S of the N African coast during spring. The systems are hard to track because of the scarcity of timely surface data over N Africa. If the depressions deepen, they are likely to move NE.

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUTION
4. Small boats. Strongest in Winter & early Spring Uncommon in Summer & early Autumn	a. E-'ly winds/waves - Creates the worst weather conditions at the port. Caused by high pressure over Turkey and low pressure over/near Egypt. Typical storm brings 35-40 kt winds, maximum 50 kt. Inner harbor has experienced swell to 13 ft (4 m). Swell is partially absorbed by rocky beach, but some reflection occurs in NE corner of harbor. At times, swell amplifies at harbor entrance. Waves at the anchorage may reach 13 ft (4 m) and last for 20 hours after wind stops.	a. Small boats may have pr harbor during strong E wind able to enter the commercia
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	b. Scirocco winds - Warm SE to SW wind originating in deserts of N Africa. Associated weather may include low stratus, fog and drizzle with reduced visibility. Also may bring dust, but dust causes no problems at the port. Heavy rain is likely near frontal boundaries and topographical barriers such as the mountains of Cyprus.	b. Little significant effe
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	c. Cyprus depressions - Generally form between Turkey and Cyprus. Most intense November through April. Associated weather includes strong-to-gale force, squally winds with heavy showers.	c. Little significant effe
Uncommon in Winter Most common in Summer, late Spring & early Autumn	d. Etesian winds - A N'ly to W'ly wind which occurs over the Aegean and E Mediterranean Seas. Local effect at Port of Limassol is a moderate W wind called "the Provences" that blows across the salt pans W of the port, sometimes reaching gale force in the afternoons.	d. Strong afternoon winds uncomfortable.

Table 3-1. (Continued)

ITIAL HAZARD	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS AN ABOUT POTENTIAL
winds/waves - Creates weather conditions at Caused by high pres- Turkey and low pres- near Egypt. Typical gs 35-40 kt winds, kt. Inner harbor enced swell to 13 ft ell is partially y rocky beach, but ction occurs in NE harbor. At times, ifies at harbor en- aves at the anchorage 13 ft (4 m) and last rs after wind stops.	a. Small boats may have problems entering the old harbor during strong E winds, but should still be able to enter the commercial harbor.	a. The winds are caused by Turkey and coincident low pr Egypt, which results in a st gradient over Cyprus. Progr reviewed with this scenario
o winds - Warm SE to ginating in deserts . Associated weath- ude low stratus, fog with reduced visi- so may bring dust, uses no problems at Heavy rain is likely l boundaries and al barriers such as ns of Cyprus.	b. Little significant effect.	b. In the E Mediterranean, nates to the S over the des Egypt, and over the Arabian When the source is the Arab tion of the Scirocco is oft distance from the N African occur most frequently durin period and are usually foun develop either over the S A or near Cyprus. See Cyprus 1.d below. A good indicati Scirocco in the E Mediterra of strong S'ly winds at sta coast of Libya.
depressions - Gener- etween Turkey and st intense November il. Associated ludes strong-to-gale lly winds with heavy	c. Little significant effect.	c. Cyprus depressions devel Taurus Mountains of Turkey from the Gulf of Antalya to develop during any season, intense from November throu associated with the develop Cyprus depression include: (1) The thermal contra water. (2) Interaction betwee stream and the subtropical (3) Effect of N'ly flo of Turkey enhancing cyclogen the southern slopes. (4) Topographic featur fronts' S movement. Cyclones also form over Sea of Crete. If one forms of a significant cold surge, SW at first, but later it w track to the Cyprus area.
n winds - A N'ly to which occurs over the E Mediterranean l effect at Port of a moderate W wind Provences" that s the salt pans W of ometimes reaching in the afternoons.	d. Strong afternoon winds may make boat work uncomfortable.	d. In the E Mediterranean curs as a SE extension of t Aegean Sea. The maximum wi through the opening between then E with reduced strengt direction of the etesian in follows the axis of maximum Crete become W, S of Cyprus.

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ARY/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
roblems entering the old is, but should still be al harbor.	a. The winds are caused by high pressure over Turkey and coincident low pressure to the S near Egypt, which results in a strengthened pressure gradient over Cyprus. Prognostic charts should be reviewed with this scenario in mind.
ect.	b. In the E Mediterranean, the Scirocco originates to the S over the deserts of Libya and Egypt, and over the Arabian desert to the SE. When the source is the Arabian desert, the direction of the Scirocco is often SE'ly. At some distance from the N African coast, Scirocco events occur most frequently during the November-April period and are usually found E of cyclones that develop either over the S Aegean Sea/Sea of Crete or near Cyprus. See Cyprus Depressions in section 1.d below. A good indication of the start of a Scirocco in the E Mediterranean is the development of strong S'ly winds at stations along the NE coast of Libya.
ct.	c. Cyprus depressions develop in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus. They can develop during any season, but usually become most intense from November through April. Factors associated with the development of an intense Cyprus depression include: (1) The thermal contrast between land and water. (2) Interaction between the polar front jet stream and the subtropical jet stream. (3) Effect of N'ly flow over the mountains of Turkey enhancing cyclogenetic activity along the southern slopes. (4) Topographic features blocking cold fronts' S movement. Cyclones also form over the S Aegean Sea and Sea of Crete. If one forms along the leading edge of a significant cold surge, it may move S or even SW at first, but later it will take a more E'ly track to the Cyprus area.
may make boat work	d. In the E Mediterranean area, the etesian occurs as a SE extension of the wind regime from the Aegean Sea. The maximum winds axis passes SE through the opening between Rhodes and Crete, and then E with reduced strength S of Cyprus. The direction of the etesian in the E Mediterranean follows the axis of maximum winds: NW winds E of Crete become W, S of Cyprus.

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUTIONA
Possible in Winter Most common in Spring Uncommon in Summer Possible in Autumn	e. N African cyclones - Low pressure systems which develop over N Africa. Primary weather concern is development of Sci-rocco conditions (i.e. low stratus, fog and drizzle with reduced visibility) in S'ly flow on E side of system.	e. Little significant e:

Table 3-1. (Continued)

TENTIAL HAZARD	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS ABOUT POTEN
frican cyclones - Low e systems which develop Africa. Primary weather is development of Sci- onditions (i.e. low , fog and drizzle with visibility) in S'ly E side of system.	e. Little significant effect.	e. N African cyclones region S of the Atlas move NE upon reaching region, but may contin African coast. Since it can be very difficu N African cyclone will Of special concern to Mediterranean are the E just S of the N Afri The systems are hard t city of timely surface depressions deepen, th

ed)

RY/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
vefect. nt T mc ic tc fe t er c ra ta ar	e. N African cyclones develop over the desert region S of the Atlas Mountains. They usually move NE upon reaching the Tunisia/Gulf of Gabes region, but may continue moving E just S of the N African coast. Since various tracks are possible, it can be very difficult to forecast when and if a N African cyclone will affect the E Mediterranean. Of special concern to the forecaster in the E Mediterranean are the desert depressions that move E just S of the N African coast during spring. The systems are hard to track because of the scarcity of timely surface data over N Africa. If the depressions deepen, they are likely to move NE.

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PORT VISIT INFORMATION

MAY 1990: NOARL Meteorologists R. Fett and R. Miller met with Port Officer and Pilot, Capt. A. Bayada to obtain much of the information included in this port evaluation.

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* Formerly the Naval Environmental Prediction Research Facility.

APPENDIX A

General Purpose Oceanographic Information

This section provides some general definitions regarding waves and is extracted from H.O. Pub. No. 603, Practical Methods for Observing and Forecasting Ocean Waves (Pierson, Neumann, and James, 1955).

Definitions

Waves that are being generated by local winds are called "SEA". WAVES that have traveled out of the generating area are known as "SWELL". Seas are chaotic in period, height and direction while swell approaches a simple sine wave pattern as its distance from the generating area increases. An in-between state exists for a few hundred miles outside the generating area and is a condition that reflects parts of both of the above definitions. In the Mediterranean area, because its fetches and open sea expanses are limited, SEA or IN-BETWEEN conditions will prevail. The "SIGNIFICANT WAVE HEIGHT" is defined as the average value of the heights of the one-third highest waves. PERIOD and WAVE LENGTH refer to the time between passage of, and distances between, two successive crests on the sea surface. The FREQUENCY is the reciprocal of the period ($f = 1/T$); therefore as the period increases the frequency decreases. Waves result from the transfer of energy from the wind to the sea surface. The area over which the wind blows is known as the FETCH, and the length of time that the wind has blown is the DURATION. The characteristics of waves (height, length, and period) depend on the duration, fetch, and velocity of the wind. There is a continuous generation of small short waves from the time the wind starts until it stops. With continual transfer of energy from the wind to the sea surface the waves grow with the older waves leading the growth and spreading the energy over a greater range of frequencies. Throughout the growth cycle a SPECTRUM of ocean waves is being developed.

A Beaufort Scale table with related wave effects is shown on the following page.

BEAUFORT SCALE

Beaufort Number	Wind Speed Knots	Wind Speed MPH	Seaman's term	Effects observed at sea	Term and height of Waves in meters
0	Under 1	Under 1	Calm	Sea like mirror.	Calm, glassy, 0
1	1-3	1-3	Light air	Ripples with appearance of scales; no foam crests.	
2	4-6	4-7	Light breeze	Small wavelets; crests of glassy appearance, not breaking	Rippled, less than 0.5
3	7-10	8-12	Gentle breeze	Large wavelets; crests begin to break; scattered whitecaps.	Smooth, 0.5
4	11-16	13-18	Moderate breeze	Small waves, becoming longer; numerous whitecaps.	Slight, 1.0
5	17-21	19-24	Fresh breeze	Moderate waves, taking longer form; many whitecaps; some spray.	Moderate, 1.0-2.5
6	22-27	25-31	Strong breeze	Larger waves forming; whitecaps everywhere; more spray.	Rough, 2.5-4.0
7	28-33	32-38	Moderate gale	Sea heaps up; white foam from breaking waves begins to be blown up in streaks.	
8	34-40	39-46	Fresh gale	Moderate high waves; edges of crests begin to break; foam is blown in steaks.	Very rough, 4.0-6.0
9	41-47	47-54	Strong gale	High waves; sea begins to roll; dense streaks of foam; spray may reduce visibility.	
10	48-55	55-63	Whole gale	Very high waves with overhanging crests; sea takes white appearance as foam is blown in very dense streaks; rolling is heavy and visibility reduced.	High, 6.0-9.0
11	56-63	64-72	Storm	Exceptionally high waves; sea covered with white foam patches; visibility still more reduced.	Very high, 9.0-13.5
12 13 14 15 16 17	64-71 72-80 81-89 90-99 100-108 109-118	73-82 83-92 93-103 104-114 115-125 126-136	Hurricane	Air filled with foam; sea completely white with driving spray; visibility greatly reduced. Winds of force 12 and above very rarely experienced on land; usually accompanied by widespread damage.	Phenomenal, greater than 13.5

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This handbook for the port of Limassol, one in a series of severe weather guides for Mediterranean ports, provides decision-making guidance for ship captains whose vessels are threatened by actual or forecast strong winds, high seas, restricted visibility or thunderstorms in the port vicinity. Causes and effects of such hazardous conditions are discussed. Precautionary or evasive actions are suggested for various vessel situations. The handbook is organized in four sections for ready reference: general guidance on handbook content and use; a quick-look captain's summary; a more detailed review of general information on environmental conditions; and an appendix that provides oceanographic information.

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